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**CS021902 Data Structures L-T-P-Cr: 3-0-2-4**

**Pre-requisites:** Knowledge of any programming language

**Objectives/Overview:**

- To understand the different data structures.
- To learn which data structure should be used to make the algorithm simpler, easier to maintain, and faster.
- To improve students' proficiency in applying basic programming knowledge to solve different problems.

**Course Outcomes:**
At the end of the course, a student is able to:

| Sl. No. | Course Outcome | Mapping to POs |
|---|---|---|
| **1.** | Understand the characteristics and operations of data structures and analyze algorithms' complexity. | PO1, PO2, PO3, PO4, PO5, PO6, PO9 |
| **2.** | Understand basic data structures such as arrays, linked lists, stacks and writes programs for them. | PO1, PO2, PO3, PO4, PO5, PO6, PO9 |
| **3.** | Become proficient in using different types of Queues, trees and implementing them. | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9 |
| **4.** | Understand and Analyze graph algorithms like shortest path and minimum spanning tree algorithms. | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9 |
| **5.** | Understand and apply searching, sorting and hashing technique and writes programs for searching and sorting. | PO1, PO2, PO3, PO4, PO5, PO6, PO7 |

**UNIT I: Introduction** **Lectures: 6**

Characteristics of data structures, creating, manipulating data structures, operations on data structure, Types of data structures – linear and nonlinear.
Introduction to algorithms: Asymptotic notations, Analysis of algorithms: Time complexity and Space complexity, Master Theorem.

**UNIT II: Arrays & Linked Lists** **Lectures: 7**

1-D arrays, multi-dimensional arrays, operations on arrays, dynamic memory allocation, different forms of matrix, Sparse Matrix.
Linked lists – Singly Linked List, Doubly Linked List, and Circularly Linked Lists, operations on Linked Lists.

**UNIT III: Stacks** **Lectures:7**

Basics of Stack data structure, Implementation of stack using arrays and linked lists, operations on stacks, Applications of Stacks, Notations – infix, prefix and postfix, Conversion and evaluation of arithmetic expressions using Stacks.

**UNIT IV: Queues** **Lectures: 5**

Basics of Queue data structure, Types of queues – Linera queue, Circular Queue, Double-ended queue, implementation of these queues using arrays and linked lists, operations on queues.

**UNIT V: Trees & Graph** **Lectures: 10**

Trees - Binary tree, Binary search tree, AVL Tree, B-Tree, Priority Queues, and Heaps.

Graph and its implementation, Graph traversals: Breadth First Search, Depth First Search, Topological sorting for Directed Acyclic Graph, Shortest Path Algorithms - Dijkstra's and Bellman-Ford algorithms. Disjoint Set ADT and its applications, Spanning Tree – Prim's and Kruskal algorithms.

**UNIT VI: Searching and Sorting** **Lectures: 7**

Linear search, Binary search, Hashing. Algorithms and data structures for sorting: Insertion sort, Bubble sort, Selection Sort, Merge sort, Quick sort, Heap sort, Bucket sort.

**Text/Reference Books**


**1)** Fundamentals of Data Structures. E. Horowitz, S. Sahni, Computer Science Press, 2nd Edition, 2008.

2) Data Structures and Algorithm Analysis in C. by Mark Allen Weiss, Pearson Education, 2nd Edition, 1997.

**3)** Data Structure and Program Design. by R. L Kruse, Prentice Hall, 2nd Edition, 1996.

**4)** Introduction to Algorithms. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, MIT Press, 2nd Edition, 2001.